



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

JAMES B. HUNT, JR.
GOVERNOR

DIVISION OF HIGHWAYS
P.O. BOX 25201, RALEIGH, N.C. 27611-5201

R. SAMUEL HUNT III
SECRETARY

June 20, 1995

MEMORANDUM TO: Sandra Stepney, P.E.
Roadway Design Project Engineer

ATTENTION: Cathy S. Metzler, P.E.

FROM: Mr. H. Franklin Vick, P.E., Manager
Planning and Environmental Branch *H.F. Vick*

SUBJECT: Greensboro Outer Loop & Relocation of
US 70, Guilford Co., Project # 8.1492901
& 6.498003, TIP # U-2581A & U-2525A,
F.A. Proj. # STP-70(22)

DESIGN NOISE REPORT

The Design Noise Report for the subject project is attached for your review, recommendations, and comments. The analysis was accomplished in accordance with Title 23 CFR, Part 772 and the N.C. Noise Abatement Guidelines. All appropriate comments made on the Draft Design Noise Report have been incorporated into this document. If you have no further recommendations or comments, this copy is for your files and distribution to local officials.

If you have any questions regarding this report, please contact Stephen Walker of the Planning and Environmental Branch at 733-3141.

cc: Project File Walker



The weighted-A scale is used almost exclusively in vehicle noise measurements because it places most emphasis on the frequency characteristics that correspond to a human's subjective response to noise. Sound levels measured using A-weighting are often expressed as dBA. Throughout this report, references will be made to dBA, which means an A-weighted decibel level. Several examples of noise pressure levels in dBA are listed in Table 1.

Review of Table 1 indicates that most individuals in urbanized areas are exposed to fairly high noise levels from many sources as they go about their daily activities. The degree of disturbance or annoyance of unwanted sound depends essentially on three things:

1. The amount and nature of the intruding noise,
2. The relationship between the background noise and the intruding noise, and
3. The type of activity occurring when the intruding noise is heard.

In considering the first of these three factors, it is important to note that individuals have different hearing sensitivity to noise. Loud noises bother some more than others and some individuals become angered if an unwanted noise persists. The time patterns of noise also enter into a person's judgement of whether or not a noise is objectionable. For example, noises occurring during sleeping hours are usually considered to be more objectionable than the same noises in the daytime.

With regard to the second factor, individuals tend to judge the annoyance of an unwanted sound in terms of its relationship to noise from other sources (background noise). The blowing of a car horn at night, when background noise levels are approximately 45 dBA, would generally be much more objectionable than the blowing of a car horn in the afternoon, when background noise levels might be 55 dBA.

The third factor is related to the disruption of an individual's activities due to noise. In a 60 dBA environment, normal conversation would be possible while sleep might be difficult. Work activities requiring high levels of concentration may be interrupted by loud noises while activities requiring manual effort may not be interrupted to the same degree.

Over a period of time, individuals tend to accept the noises which intrude into their daily lives, particularly if the noises occur at predicted intervals and are expected. Attempts have been made to regulate many of these types of noises including airplane noises, factory noise, railroad noise, and highway traffic noise. In relation to highway traffic noise, methods of analysis and control have developed rapidly over the past few years.

NOISE ABATEMENT CRITERIA

To determine if highway noise levels are compatible with various land uses, the FHWA has developed noise abatement criteria and procedures to be used in the planning and design of highways. These abatement criteria and procedures are in accordance with Title 23 Code of Federal Regulations (CFR), Part 772, U.S. Department of Transportation, Federal Highway Administration (FHWA), Procedures for Abatement of Highway Traffic Noise and Construction Noise. A summary of the FHWA Noise Abatement Criteria (NAC) for various land uses is presented in Table 2. Sound pressure levels in this report are referred to as Leq(h). The hourly Leq, or equivalent sound level, is the level of constant sound which in an hour would contain the same acoustic energy as the time-varying sound. In other words, the fluctuating sound levels of traffic noise are represented in terms of a steady noise level with the same energy content. Also, One factor for considering traffic noise mitigation is when future noise levels either approach or exceed the criteria levels for each activity category. Title 23 CFR, Section 772.11(a) states, "In determining and abating traffic noise impacts, primary consideration is to be given to exterior areas. Abatement will usually be necessary only where frequent human use occurs and a lowered noise level would be of benefit." For this project, all the identified receptors were residential or commercial development.

AMBIENT NOISE LEVELS

Ambient noise is that which results from natural and mechanical sources and human activity, and that which is considered to be usually present in a particular area. Ambient noise measurements were taken in the vicinity of the project to determine the existing background noise levels. The purpose of this noise level information was to quantify the existing acoustic environment and to provide a base for assessing the impact of future noise levels from the project on the receptors in the vicinity of the project. Field measurements were taken using a GenRad 1988 Precision Integrating Sound-Level Meter and Analyzer. The microphone was located at strategic points, 15 meters (50') from the near lane of travel and at an elevation approximately 1.5 meters (5') above the existing ground. The ambient measurement sites and measured Leq noise levels are presented in Figure N2 and Table 3, respectively.

The existing roadway and traffic conditions were used with the most current traffic noise prediction model in order to calculate existing noise levels for comparison with noise levels actually measured. The calculated existing noise levels were within 0.9 to 3.4 dBA of the measured noise levels for the locations where noise measurements were obtained. Differences in dBA levels can be attributed to "bunching" of vehicles, low traffic volumes, and actual vehicle speeds versus the computer's "evenly-spaced" vehicles and single vehicular speed.

PROCEDURE FOR PREDICTING FUTURE NOISE LEVELS

The prediction of highway traffic noise is a complicated procedure. Generally, traffic is composed of a large number of variables which describe different vehicles driving at different speeds through a continually changing highway configuration and surrounding terrain. Obviously, to assess the problem certain assumptions and simplifications must be made.

The BCR traffic noise prediction model uses the number and type of vehicles on the planned roadway, their speeds, the physical characteristics of the road (horizontal and vertical alignment, grades, cut or fill sections, etc.), receptor location and height, and, if applicable, barrier type, barrier ground elevation, and barrier top elevation.

The noise predictions made in this report are highway-related noise predictions for the traffic conditions during the year being analyzed. Design hour and level-of-service (LOS) C volumes were compared and the volumes which resulted in the noisiest conditions was used with posted speeds to predict future noise levels. During all other time periods, the noise levels will be no greater than those indicated in this report.

First, this computerized model was used to determine the number of land uses (by type) which would be impacted during the peak hour in the design year 2015. The basic approach was to select receptor locations at 7.5, 15, 30, 60, 120, 240, and 480 meters from the center of the near traffic lane (adaptable to both sides of the roadway). The result of this procedure was a grid of receptor points along the project alignment. Using this grid, noise levels were calculated for each identified receptor along the project.

The Leq traffic noise exposures associated with this project are listed in Table 4. Information included in this table is a listing of all receptors in close proximity to the project, their ambient and predicted noise levels, and the estimated noise level increases for each.

The exposure impacts of the project are listed in Table 5 and are noted in terms of those receptors expected to experience traffic noise impacts by approaching or exceeding the FHWA NAC or by a substantial increase in exterior noise levels. Other information included in Table 5 is the maximum extent of the 67 dBA and the 72 dBA noise level contours and the predicted noise levels at 15, 30, and 60 meters for each roadway segment. The 67 dBA and 72 dBA noise level contours are generally used to assess the exposure impacts of land use since receptors, particularly residential receptors which are located within the 67 dBA noise level contour, could be expected to experience traffic noise levels above the FHWA NAC. Furthermore, this information is provided to assist local authorities in exercising land use control over the remaining undeveloped lands adjacent to the

roadway and to prevent further development of incompatible activities and land uses.

Table 6 indicates the change in exterior traffic noise levels for the project's identified receptors. The exterior noise increase is predicted to increase in the range of 0 to 31 dBA. Increases of this magnitude are typical on new location projects, due to the absence of substantial traffic noise in the existing acoustic environment.

TRAFFIC NOISE IMPACT ANALYSIS/ABATEMENT MEASURES

Traffic noise impacts occur when a) the predicted design year noise levels approach or exceed those values shown for the appropriate activity category of the FHWA Noise Abatement Criteria (Table 2), with approach values being 1 dBA less than shown in the table; or b) the predicted design year noise levels substantially exceed existing noise levels, as defined in Table 7.

For proposed federal roadway projects, the FHWA requires that States consider noise abatement measures for receptors which fall in either category. The following discussion addresses the applicability of these measures to the proposed project.

Highway Alignment Selection

Alignment selection involves the horizontal or vertical orientation of the proposed improvements in such a way as to minimize impacts and costs. The selection of alternative alignments for noise abatement purposes must consider the balance between noise impacts and other engineering and environmental parameters. For noise abatement, horizontal alignment selection is primarily a matter of siting the roadway at a sufficient distance from noise sensitive areas. The recommended alignment selected for this project has been evaluated to provide a balance between travel needs and other engineering and environmental parameters.

Changes in the vertical alignment can be effective in limiting noise impacts of certain highway facilities. However, no major alterations in the vertical alignment are practical for noise purposes in the design of this project. The existing vertical alignment is designed to accepted interstate standards, and is suitable for the substantial number of heavy trucks that will use this facility. The operation of heavy trucks can be adversely affected if the vertical grades are excessively steep and/or long. Any changes to the vertical alignment are also restricted by existing grade-separated roadway crossings and interchanges along this project.

Traffic System Management Measures

Traffic system management measures which limit vehicle type, speed, volume and time of operations are often effective noise abatement measures. For this project, traffic management measures are not considered appropriate for noise abatement due to their effect on the capacity and level-of-service of the widened freeway.

Past project experience has shown that a reduction in the speed limit of 10 mph would result in a noise level reduction of approximately 1 to 2 dBA. Because most people cannot detect a noise reduction of up to 3 dBA and because reducing the speed limit would reduce roadway capacity, it is not considered a viable noise abatement measure. This and other traffic system management measures, including the prohibition of truck operations, are not considered to be consistent with the project's objective of providing a high-speed, limited-access facility.

Noise Barriers

Noise barriers reduce noise levels by blocking the sound path between a roadway and noise sensitive areas. This measure is most often used on high-speed, limited-access facilities where noise levels are high and there is adequate space for continuous barriers. Noise barriers may be constructed from a variety of materials, either individually or combined, including concrete, wood, metal, earth and vegetation.

Due to several traffic noise impacts predicted for the 2015 design year, a noise barrier evaluation was conducted for this project. The evaluation was accomplished in two steps. First, a qualitative barrier evaluation was performed for each impacted receptor which considered each receptor's FHWA NAC activity category, source-receptor relationships, impacted site densities, and the ability to have continuous barriers. The qualitative evaluation resulted in the selection of only one potential barrier location, to possibly reduce or eliminate future traffic noise impacts. This location was at the Gallant Estates Mobile Home Park, located in the northeast quadrant of the proposed interchange of the Greensboro Outer Loop and the Relocated US 70.

All other impacted receptors in the vicinity of the project are either isolated or in areas that the right-of-way is not controlled. Past project experience has shown that a cost-effective wall (one costing less than \$25,000 per benefitted residence) cannot be designed or constructed for isolated receptors. For a noise barrier to provide sufficient noise reduction it must be high enough and long enough to shield the receptor from significant sections of the highway. Access openings in the barrier created by driveways or intersections severely reduce the noise reduction provided by the barrier. It then becomes economically unreasonable to construct a barrier for a small noise reduction. Safety at access openings (driveways,

crossing streets, etc.) due to restricted sight distance is also a concern. Furthermore, to provide a sufficient reduction, a barrier's length would normally be 8 times the distance from the barrier to the receptor. For example, a receptor located 15 meters from the barrier would normally require a barrier 120 meters long. An access opening of 12 meters (10 percent of the area) would limit its noise reduction to approximately 4 dBA (FUNDAMENTAL AND ABATEMENT OF HIGHWAY TRAFFIC NOISE, Report No. FHWA-HHI-HEV-73-7976-1, USDOT, chapter 5, section 3.2, page 5-27). Hence, these factors would not allow noise walls to be acceptable abatement measures along the right-of-way that is not controlled.

The second step of the barrier evaluation involved the computer modeling of noise barriers at the potential location, using the FHWA's noise barrier simulation model, OPTIMA. The analysis was accomplished by developing barriers with OPTIMA which would meet minimum noise reduction goals at the impacted site, by estimating the cost of the barrier, and by determining the cost per benefitted receptor. The NCDOT defines benefitted receptors as all receptors, impacted and non-impacted, which, by placement of the noise mitigation measure, receive a minimum noise level reduction of 4 dBA.

In order for a noise barrier to be considered feasible, it must meet, among other factors, the following conditions:

1. Provide a minimum insertion loss of 6 dBA, preferably 8 dBA or more (for receptors directly adjacent to the project);
2. Located in an acoustic environment where no other noise sources are present.
3. Suitable for construction given the topography of the location.

A primary consideration of the reasonableness of noise barrier installation is that it costs no more than \$25,000 per benefitted receptor (those impacted or non-impacted receptors receiving 4 dBA or more reduction).

Noise abatement, in the form of a concrete barrier, was analyzed for Gallant Estates Mobile Home Park, located in the northeast quadrant of the Relocated US 70 and Greensboro Northern/Eastern Loop interchange. Only the closest 50 mobile homes were used for the study; the addition of the remainder would have added no impacts or benefits. The optimized preliminary design for the noise wall was 198 meters in length, and exposed height ranged from 4.5 to 6.5 meters. This barrier would effectively protect 9 of the 14 impacted receptors of the mobile home park at a cost of \$171,400, or \$19,045 per receptor. This barrier is considered reasonable and feasible by NCDOT guidelines and is recommended for construction, contingent on completion of the project design and the public involvement process.

CONSTRUCTION NOISE

The major construction elements of this project are expected to be earth removal, hauling, grading, and paving. General construction noise impacts, such as temporary speech interference for passersby and those individuals living or working near the project, can be expected particularly from paving operations and from the earth moving equipment during grading operations. Overall, construction noise impacts are expected to be minimal, since the construction noise is relatively short in duration and is generally restricted to daytime hours. Furthermore, the transmission loss characteristics of surrounding wooded areas and other natural and man-made features are considered sufficient to moderate the effects of intrusive construction noise.

SUMMARY

Noise impacts are an unavoidable consequence of roadway projects. A total of 67 residences and 10 businesses will become impacted by highway traffic noise with the construction of this project. Most of the impacted receptors are either isolated or located where the right-of-way is not controlled; thus, making the placement of barriers not feasible or reasonable. The only area, that meets NCDOT feasibility and reasonableness requirements for noise abatement measures, is the Gallant Estates Mobile Home Park. Hence, NCDOT recommends the construction of this wall as part of this project, contingent on the completion of the project design and the public involvement process. In lieu of concrete walls, or in areas of densely populated impacted receptors, vegetative plantings could be provided for visual screening, contingent on funding, as a psychological mitigation measure during the final design of the project.

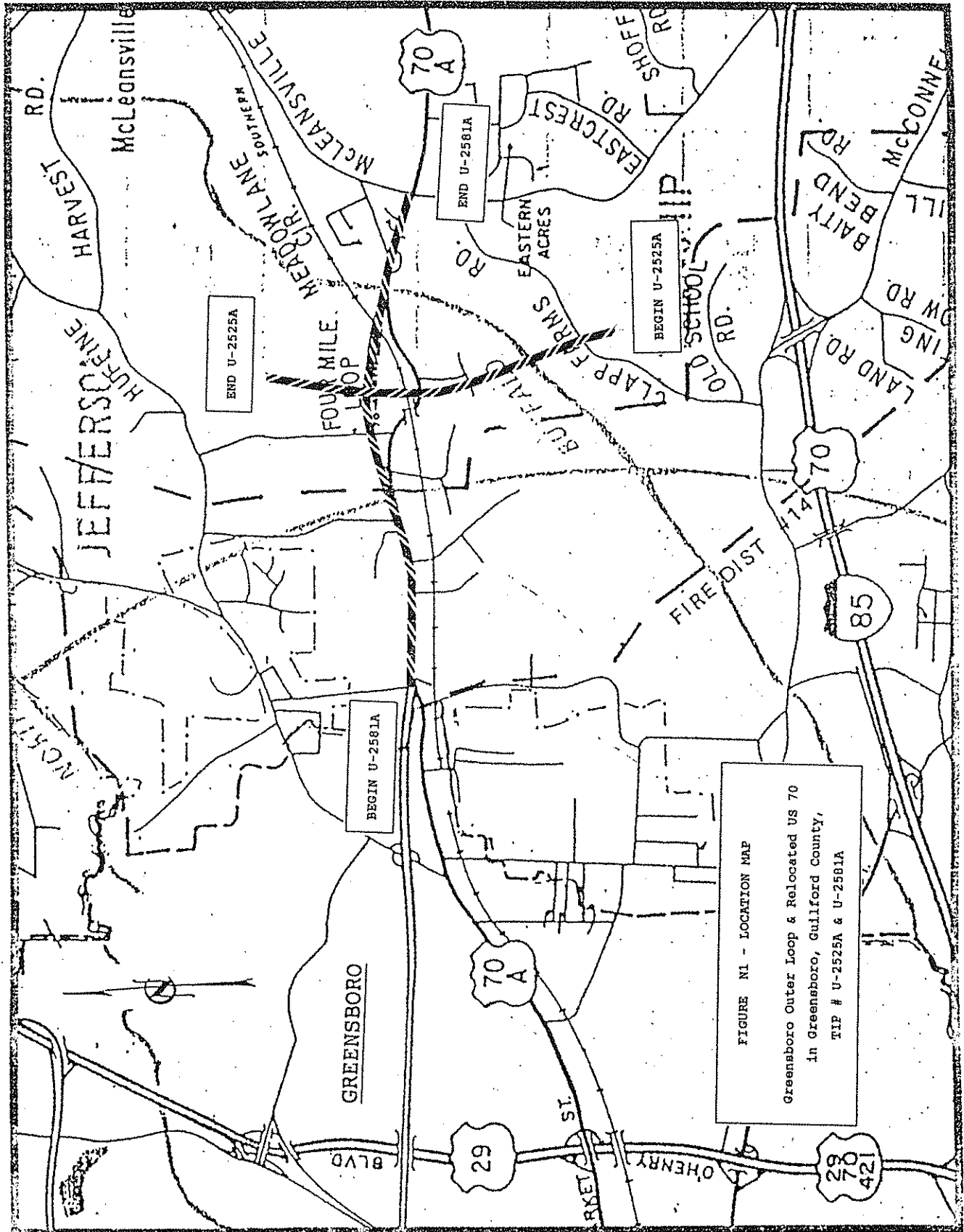


FIGURE N1 - LOCATION MAP

Greensboro Outer Loop & Relocated US 70
in Greensboro, Guilford County,
TIP # U-2525A & U-2581A

TABLE 1

HEARING: SOUNDS BOMBARDING US DAILY

140	Shotgun blast, jet 30 m away at takeoff	PAIN
	Motor test chamber	HUMAN EAR PAIN THRESHOLD
130	Firecrackers	
120	Severe thunder, pneumatic jackhammer	
	Hockey crowd	
	Amplified rock music	UNCOMFORTABLY LOUD
110	Textile loom	
100	Subway train, elevated train, farm tractor	
	Power lawn mower, newspaper press	
	Heavy city traffic, noisy factory	LOUD
90	Diesel truck 65 kmph 15 m away	
D 80	Crowded restaurant, garbage disposal	
C	Average factory, vacuum cleaner	
I	Passenger car 80 kmph 15 m away	MODERATELY LOUD
B 70	Quiet typewriter	
E	Singing birds, window air-conditioner	
L 60	Quiet automobile	
S	Normal conversation, average office	QUIET
50	Household refrigerator	
	Quiet office	VERY QUIET
40	Average home	
30	Dripping faucet	
	Whisper 1.5 m away	
20	Light rainfall, rustle of leaves	
	AVERAGE PERSON'S THRESHOLD OF HEARING	
	Whisper	JUST AUDIBLE
10		
0		THRESHOLD FOR ACUTE HEARING

Sources: World Book, Rand McNally Atlas of the Human Body,
 Encyclopedia Americana, "Industrial Noise and Hearing
 Conversation" by J. B. Olishifski and E. R. Harford
 (Researched by N. Jane Hunt and published in the Chicago
 Tribune in an illustrated graphic by Tom Heinz.)

TABLE 2

NOISE ABATEMENT CRITERIA

Hourly A-Weighted Sound Level - decibels (dBA)

Activity Category	Leq(h)	Description of Activity Category
A	57 Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 Exterior	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 Exterior	Developed lands, properties, or activities not included in Categories A or B above.
D	--	Undeveloped lands
E	52 Interior	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: Title 23 Code of Federal Regulations (CFR) Part 772,
U.S. Department of Transportation, Federal Highway
Administration

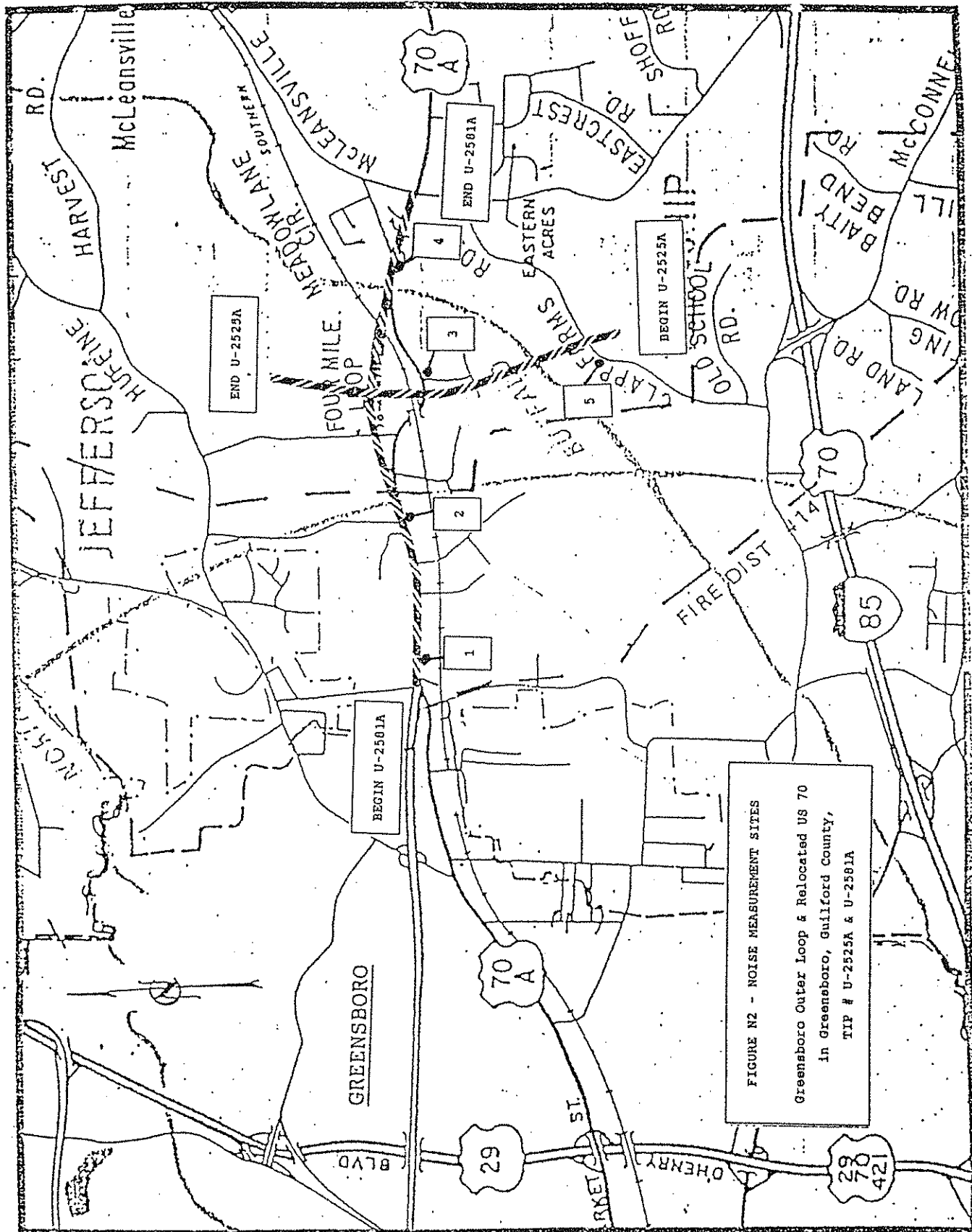


TABLE 3

AMBIENT NOISE LEVELS
(Leq)

Greensboro Outer Loop & Relocated US 70 in Greensboro,
Guilford County, TIP # U-2525A & U-2581A
Project # 6.498003T & 8.1492901

SITE	LOCATION	DESCRIPTION	NOISE LEVEL (dBA)
1.	US 70, 0.6 km East of SR 2851 (Penry Road)	Paved	67
2.	US 70, 0.2 km West of SR 3040 (Wagoner Bend Road)	Grassy	69
3.	US 70 at SR 3155	Gravel	71
4.	US 70 at Royce Circle	Grassy	70
5.	SR 3041 (Clapp Farm Road), 0.2 km East of Proposed Outer Loop	Grassy	58

Note: The ambient noise level sites were measured at 15 meters from the center of the nearest lane of traffic.

Leq TRAFFIC NOISE EXPOSURES

Greensboro Outer Loop & Relocated US 70 in Greensboro
 Guilford County, State Proj.# 6.498003T & 8.1492901, TIP # U-2525A & U-2581A

RECEPTOR INFORMATION			AMBIENT			NEAREST			PREDICTED NOISE LEVELS			NOISE
ID #	LAND USE CATEGORY		NEAREST ROADWAY NAME	DISTANCE (m)	NOISE LEVEL	PROPOSED ROADWAY NAME	DISTANCE (m)		-L-	-Y-	MAXIMUM	LEVEL INCREASE
Greensboro Outer Loop from STA 1+340 to Relocated US 70 Interchange												
2	Residence	B	SR 3041	64.0 R	47	LOOP	56.0 R	-	-	-	* 69	* + 22
3	Residence	B	"	44.0 R	50	"	64.0 R	-	-	-	* 67	* + 17
5	Residence	B	"	14.0 L	58	"	125.0 L	-	-	-	60	+ 2
6	Residence	B	"	168.0 R	45	"	64.0 L	-	-	-	* 67	* + 22
7	Residence	B	"	46.0 R	50	"	177.0 L	-	-	-	55	+ 5
8	Residence	B	"	44.0 L	50	"	255.0 L	-	-	-	50	0
9	Residence	B	"	37.0 L	52	"	165.0 R	-	-	-	56	+ 4
10	Residence	B	"	13.0 L	58	"	262.0 R	-	-	-	50	- 8
11	Business	C	OLD US70	329.0 L	45	"	419.0 R	-	-	-	45	0
12	Residence	B	"	26.0 R	67	"	166.0 L	-	-	-	56	- 11
13	Residence	B	"	28.0 R	67	"	140.0 L	-	-	-	58	- 9
14	Residence	B	"	123.0 R	53	"	64.0 L	-	-	-	* 67	* + 14
21	Residence	B	"	31.0 R	66	"	78.0 R	-	-	-	65	- 1
22	Residence	B	"	18.0 R	70	"	113.0 R	-	-	-	61	- 9
23	Residence	B	"	16.0 R	70	"	144.0 R	-	-	-	58	- 12
24	Residence	B	"	71.0 R	59	"	167.0 R	-	-	-	56	- 3
25	Residence	B	"	34.0 R	65	"	213.0 R	-	-	-	53	- 12
26	Residence	B	"	23.0 R	68	"	256.0 R	-	-	-	50	- 18
27	Residence	B	"	55.0 R	61	"	250.0 R	-	-	-	51	- 10
38	Residence	B	"	113.0 L	54	"	119.0 L	60.9	51.9	-	61	+ 7
39	Business	C	"	30.0 L	66	"	247.0 R	-	-	-	51	- 15
41	Residence	B	4 MI LOOP	16.0 R	45	"	213.0 L	53.2	74.0	-	* 74	* + 29
46	Residence	B	"	12.0 R	45	"	43.0 R	72.0	74.3	-	* 76	* + 31

Greensboro Outer Loop from Relocated US 70 Interchange to STA 4+510

47	Residence	B	4 MI LOOP	29.0 L	45	LOOP	259.0 L	49.8	71.1	* 71	* + 26
55A	Residence	B	SR 2828	108.0 L	45	"	235.0 L	-	-	51	+ 6
56A	Residence	B	"	114.0 L	45	"	238.0 L	-	-	50	+ 5
57A	Residence	B	"	87.0 L	45	"	277.0 L	-	-	49	+ 4

NOTE: Distances are from center of the existing or proposed roadways. -L==> Proposed roadway's noise level contribution.
 All noise levels are hourly A-weighted noise levels. -Y==> Noise level from other contributing roadways
 Category E noise levels shown as exterior/interior (58/48). * ==> Traffic noise impact (per 23 CFR Part 772).

Leq TRAFFIC NOISE EXPOSURES

Greensboro Outer Loop & Relocated US 70 in Greensboro
 Guilford County, State Proj.# 6.498003T & 8.1492901, TIP # U-2525A & U-2581A

RECEPTOR INFORMATION			NEAREST ROADWAY		AMBIENT NOISE LEVEL	NEAREST PROPOSED ROADWAY		PREDICTED NOISE LEVELS	NOISE LEVEL INCREASE
ID #	LAND USE CATEGORY		NAME	DISTANCE (m)		NAME	DISTANCE (m)	-L- -Y- MAXIMUM	
Gallant Estates Mobile Home Park									
53	Business	C	4 MI LOOP	41.0 L	45	NEW US70	41.0 L	- - 69	* + 24
58	Residence	B	"	110.0 L	45	"	116.0 L	- - 60	* + 15
59	Residence	B	"	119.0 L	45	"	124.0 L	- - 58	+ 13
60	Residence	B	"	128.0 L	45	"	133.0 L	- - 56	+ 11
61	Residence	B	"	138.0 L	45	"	141.0 L	- - 55	+ 10
62	Residence	B	"	155.0 L	45	"	157.0 L	- - 55	+ 10
63	Residence	B	"	166.0 L	45	"	170.0 L	- - 54	+ 9
64	Residence	B	"	39.0 L	45	"	46.0 L	- - 65	* + 20
65	Residence	B	"	36.0 L	45	"	42.0 L	- - * 66	* + 21
66	Residence	B	"	38.0 L	45	"	43.0 L	- - 65	* + 20
67	Residence	B	"	36.0 L	45	"	41.0 L	- - 65	* + 20
68	Residence	B	"	78.0 L	45	"	84.0 L	- - 60	* + 15
69	Residence	B	"	77.0 L	45	"	82.0 L	- - 60	* + 15
70	Residence	B	"	108.0 L	45	"	113.0 L	- - 57	+ 12
71	Residence	B	"	111.0 L	45	"	113.0 L	- - 57	+ 12
72	Residence	B	"	113.0 L	45	"	115.0 L	- - 57	+ 12
73	Residence	B	"	109.0 L	45	"	113.0 L	- - 56	+ 11
74	Residence	B	"	109.0 L	45	"	111.0 L	- - 56	+ 11
75	Residence	B	"	110.0 L	45	"	111.0 L	- - 56	+ 11
76	Residence	B	"	107.0 L	45	"	108.0 L	- - 56	+ 11
77	Residence	B	"	121.0 L	45	"	121.0 L	- - 56	+ 11
78	Residence	B	"	106.0 L	45	"	106.0 L	- - 57	+ 12
79	Residence	B	"	94.0 L	45	"	94.0 L	- - 58	+ 13
80	Residence	B	"	82.0 L	45	"	82.0 L	- - 59	+ 14
81	Residence	B	"	70.0 L	45	"	70.0 L	- - 64	* + 19
82	Residence	B	"	79.0 L	45	"	80.0 L	- - 58	+ 13
83	Residence	B	"	78.0 L	45	"	81.0 L	- - 58	+ 13
84	Residence	B	"	78.0 L	45	"	81.0 L	- - 59	+ 14
85	Residence	B	"	77.0 L	45	"	80.0 L	- - 59	+ 14
86	Residence	B	"	77.0 L	45	"	81.0 L	- - 59	+ 14
87	Residence	B	"	77.0 L	45	"	82.0 L	- - 59	+ 14
88	Residence	B	"	38.0 L	45	"	42.0 L	- - 65	* + 20
89	Residence	B	"	36.0 L	45	"	40.0 L	- - * 68	* + 23

NOTE: Distances are from center of the existing or proposed roadways. -L=> Proposed roadway's noise level contribution.
 All noise levels are hourly A-weighted noise levels. -Y=> Noise level from other contributing roadways
 Category E noise levels shown as exterior/interior (58/48). * => Traffic noise impact (per 23 CFR Part 772).

Leq TRAFFIC NOISE EXPOSURES

Greensboro Outer Loop & Relocated US 70 in Greensboro
 Guilford County, State Proj.# 6.498003T & 8.1492901, TIP # U-2525A & U-2581A

RECEPTOR INFORMATION			NEAREST ROADWAY		AMBIENT NOISE LEVEL	NEAREST PROPOSED ROADWAY		PREDICTED NOISE LEVELS			NOISE LEVEL INCREASE		
ID #	LAND USE CATEGORY		NAME	DISTANCE (m)			NAME	DISTANCE (m)	-L-	-Y-	MAXIMUM		
Gallant Estates Mobile Home Park (Cont'd)													
90	Residence	B	OLD US70	39.0	L	45	NEW US70	42.0	L	-	-	65	* + 20
91	Residence	B	"	40.0	L	45	"	42.0	L	-	-	65	* + 20
92	Residence	B	"	42.0	L	45	"	43.0	L	-	-	65	* + 20
93	Residence	B	"	46.0	L	45	"	47.0	L	-	-	65	* + 20
US 70 from Greensboro Outer Loop Interchange to Mt. Hope Church Road													
94	Residence	B	OLD US70	37.0	R	63	NEW US70	128.0	R	-	-	54	- 9
95	Business	C	"	27.0	R	66	"	101.0	R	-	-	57	- 9
96	Business	C	"	55.0	R	60	"	101.0	R	-	-	57	- 3
97	Residence	B	"	24.0	R	67	"	78.0	R	-	-	60	- 7
98	Business	C	"	52.0	L	60	"	75.0	L	-	-	60	0
99	Residence	B	"	170.0	R	47	"	134.0	R	-	-	54	+ 7
100	Residence	B	"	130.0	R	51	"	88.0	R	-	-	58	+ 7
101	Residence	B	"	105.0	R	53	"	64.0	R	-	-	62	+ 9
102	Residence	B	"	81.0	R	56	"	40.0	R	-	-	* 66	* + 10
105	Residence	B	"	155.0	R	49	"	119.0	R	-	-	55	+ 6
106	Residence	B	"	143.0	R	50	"	111.0	R	-	-	56	+ 6
107	Residence	B	"	129.0	R	51	"	88.0	R	-	-	58	+ 7
108	Residence	B	"	111.0	R	53	"	82.0	R	-	-	59	+ 6
109	Residence	B	"	90.0	R	55	"	57.0	R	-	-	63	+ 8
110	Residence	B	"	68.0	R	58	"	34.0	R	-	-	* 67	+ 9
112	Residence	B	"	105.0	R	53	"	80.0	R	-	-	59	+ 6
113	Residence	B	"	79.0	R	56	"	56.0	R	-	-	63	+ 7
114	Business	C	"	21.0	L	67	"	72.0	L	-	-	61	- 6
115	Residence	B	"	26.0	L	66	"	71.0	L	-	-	61	- 5
116	Residence	B	"	30.0	L	65	"	72.0	L	-	-	61	- 4
117	Residence	B	"	32.0	L	65	"	70.0	L	-	-	61	- 4
118	Residence	B	"	34.0	L	64	"	69.0	L	-	-	61	- 3
119	Residence	B	"	38.0	L	63	"	69.0	L	-	-	61	- 2
120	Residence	B	"	41.0	L	62	"	68.0	L	-	-	61	- 1
121	Residence	B	"	46.0	L	62	"	69.0	L	-	-	61	- 1
122	Residence	B	"	50.0	L	61	"	67.0	L	-	-	61	0

NOTE: Distances are from center of the existing or proposed roadways. -L=> Proposed roadway's noise level contribution.
 All noise levels are hourly A-weighted noise levels. -Y=> Noise level from other contributing roadways
 Category E noise levels shown as exterior/interior (58/48). * => Traffic noise impact (per 23 CFR Part 772).

Leq TRAFFIC NOISE EXPOSURES

Greensboro Outer Loop & Relocated US 70 in Greensboro
Guilford County, State Proj.# 6.498003T & 8.1492901, TIP # U-2525A & U-2581A

RECEPTOR INFORMATION			NEAREST ROADWAY		AMBIENT NOISE LEVEL	NEAREST PROPOSED ROADWAY		PREDICTED NOISE LEVELS		NOISE LEVEL INCREASE
ID #	LAND USE	CATEGORY	NAME	DISTANCE (m)		NAME	DISTANCE (m)	-L-	-Y-	MAXIMUM
US 70 from Greensboro Outer Loop Interchange to Mt. Hope Church Road (Cont'd)										
123	Residence	B	OLD US70	64.0 L	59	NEW US70	76.0 L	-	-	60 + 1
124	Residence	B	"	100.0 L	54	"	115.0 L	-	-	55 + 1
125	Residence	B	"	86.0 L	55	"	94.0 L	-	-	58 + 3
126	Residence	B	"	104.0 L	53	"	109.0 L	-	-	56 + 3
127	Business	C	"	34.0 R	64	"	23.0 R	-	-	70 + 6
128	Residence	B	"	36.0 R	64	"	28.0 R	-	-	* 69 + 5
128A	Residence	B	"	113.0 R	52	"	104.0 R	-	-	56 + 4
129	Residence	B	"	32.0 R	65	"	29.0 R	-	-	* 69 + 4
130	Residence	B	"	25.0 R	66	"	24.0 R	-	-	* 70 + 4
131	Residence	B	"	58.0 R	60	"	58.0 R	-	-	63 + 3
132	Business	C	"	32.0 R	65	"	32.0 R	-	-	68 + 3
133	Business	C	"	14.0 L	70	"	24.0 L	-	-	70 0
134	Residence	B	"	20.0 L	68	"	20.0 L	-	-	* 71 + 3
136	Residence	B	"	62.0 L	59	"	62.0 L	-	-	62 + 3
137	Residence	B	"	78.0 L	56	"	78.0 L	-	-	60 + 4
138	Residence	B	"	81.0 L	56	"	81.0 L	-	-	59 + 3
139	Residence	B	"	18.0 L	69	"	18.0 L	-	-	* 72 + 3
140	Residence	B	"	152.0 L	49	"	152.0 L	-	-	52 + 3
141	Residence	B	"	21.0 L	67	"	21.0 L	-	-	* 71 + 4
142	Residence	B	"	82.0 L	56	"	82.0 L	-	-	59 + 3
143	Residence	B	"	123.0 L	52	"	123.0 L	-	-	55 + 3
145	Residence	B	"	147.0 L	49	"	147.0 L	-	-	52 + 3
146	Business	C	"	38.0 L	63	"	38.0 L	-	-	67 + 4
147	Business	C	"	47.0 R	61	"	47.0 R	-	-	65 + 4
148	Business	C	"	52.0 R	60	"	51.0 R	-	-	64 + 4

US 70 from SR 2581 (Penry Road) to Greensboro Outer Loop Interchange

148A	Residence	B	OLD US70	33.0 L	62	NEW US70	33.0 L	-	-	* 69 + 7
149	Residence	B	"	18.0 L	66	"	18.0 L	-	-	* 73 + 7
150	Residence	B	"	80.0 L	54	"	80.0 L	-	-	61 + 7
151	Residence	B	"	61.0 L	57	"	61.0 L	-	-	63 + 6
152	Residence	B	"	40.0 L	61	"	40.0 L	-	-	* 67 + 6

NOTE: Distances are from center of the existing or proposed roadways. -L==> Proposed roadway's noise level contribution.
All noise levels are hourly A-weighted noise levels. -Y==> Noise level from other contributing roadways
Category E noise levels shown as exterior/interior (58/48). * ==> Traffic noise impact (per 23 CFR Part 772).

Leq TRAFFIC NOISE EXPOSURES

Greensboro Outer Loop & Relocated US 70 in Greensboro
 Guilford County, State Proj.# 6.498003T & 8.1492901, TIP # U-2525A & U-2581A

RECEPTOR INFORMATION			NEAREST ROADWAY		AMBIENT NOISE		NEAREST PROPOSED ROADWAY		PREDICTED NOISE LEVELS			NOISE
ID #	LAND USE	CATEGORY	NAME	DISTANCE (m)		LEVEL	NAME	DISTANCE (m)	-L-	-Y-	MAXIMUM	LEVEL INCREASE
US 70 from SR 2581 (Penry Road) to Greensboro Outer Loop Interchange (Cont'd)												
153	Residence	B	OLD US70	39.0	L	61	NEW US70	39.0	L	-	-	* 67 + 6
154	Residence	B	"	45.0	L	59	"	45.0	L	-	-	* 66 + 7
155	Business	C	"	14.0	L	68	"	14.0	L	-	-	* 75 + 7
156	Business	C	"	14.0	L	68	"	14.0	L	-	-	* 75 + 7
157	Business	C	"	29.0	R	63	"	29.0	R	-	-	70 + 7
158	Business	C	"	27.0	R	64	"	27.0	R	-	-	70 + 6
159	Business	C	"	145.0	R	47	"	145.0	R	-	-	54 + 7
160	Business	C	"	18.0	R	66	"	18.0	R	-	-	* 73 + 7
161	Residence	B	"	21.0	L	65	"	21.0	L	-	-	* 72 + 7
162	Residence	B	"	63.0	L	57	"	63.0	L	-	-	63 + 6
163	Business	C	"	24.0	L	64	"	24.0	L	-	-	* 71 + 7
164	Residence	B	"	54.0	L	58	"	54.0	L	-	-	64 + 6
165	Business	C	"	55.0	R	58	"	55.0	R	-	-	64 + 6
166	Residence	B	"	23.0	R	65	"	23.0	R	-	-	* 72 + 7
167	Business	C	"	35.0	R	62	"	35.0	R	-	-	68 + 6
168	Residence	B	"	20.0	R	66	"	22.0	R	-	-	* 72 + 6
169	Residence	B	"	22.0	R	65	"	25.0	R	-	-	* 71 + 6
170	Business	C	"	19.0	R	66	"	19.0	R	-	-	* 73 + 7
171	Business	C	"	25.0	R	64	"	25.0	R	-	-	* 71 + 7
172	Residence	B	"	31.0	L	63	"	30.0	L	-	-	* 70 + 7
173	Business	C	"	37.0	L	61	"	37.0	L	-	-	68 + 7
174	Business	C	"	41.0	L	60	"	41.0	L	-	-	67 + 7
174A	Residence	B	"	70.0	L	55	"	70.0	L	-	-	62 + 7
174B	Residence	B	"	104.0	L	51	"	104.0	L	-	-	58 + 7
175	Residence	B	"	28.0	L	63	"	28.0	L	-	-	* 70 + 7
176	Residence	B	"	29.0	L	63	"	29.0	L	-	-	* 70 + 7
177	Residence	B	"	30.0	L	63	"	30.0	L	-	-	* 70 + 7
178	Residence	B	"	47.0	L	59	"	47.0	L	-	-	* 66 + 7
179	Residence	B	"	31.0	L	63	"	31.0	L	-	-	* 69 + 6
179A	Residence	B	"	72.0	L	55	"	72.0	L	-	-	62 + 7
180	Residence	B	"	31.0	R	63	"	31.0	R	-	-	* 69 + 6
181	Residence	B	"	30.0	R	63	"	30.0	R	-	-	* 70 + 7
182	Business	C	"	30.0	R	63	"	30.0	R	-	-	70 + 7

NOTE: Distances are from center of the existing or proposed roadways. -L=> Proposed roadway's noise level contribution.
 All noise levels are hourly A-weighted noise levels. -Y=> Noise level from other contributing roadways
 Category E noise levels shown as exterior/interior (58/48). * => Traffic noise impact (per 23 CFR Part 772).

Leq TRAFFIC NOISE EXPOSURES

Greensboro Outer Loop & Relocated US 70 in Greensboro
 Guilford County, State Proj.# 6.498003T & 8.1492901, TIP # U-2525A & U-2581A

RECEPTOR INFORMATION		NEAREST ROADWAY		AMBIENT NOISE		NEAREST PROPOSED ROADWAY		PREDICTED NOISE LEVELS			NOISE LEVEL INCREASE		
ID #	LAND USE CATEGORY	NAME	DISTANCE (m)		LEVEL	NAME	DISTANCE (m)	-L-	-Y-	MAXIMUM			
US 70 from SR 2581 (Penry Road) to Greensboro Outer Loop Interchange (Cont'd)													
182A	Residence	B	OLD US70	40.0	R	61	NEW US70	40.0	R	-	-	* 67	+ 6
183	Business	C	"	18.0	R	66	"	18.0	R	-	-	* 73	+ 7
184	Business	C	"	48.0	R	59	"	48.0	R	-	-	66	+ 7
185	Residence	B	"	26.0	R	65	"	26.0	R	-	-	* 71	+ 6
186	Residence	B	"	27.0	R	65	"	27.0	R	-	-	* 70	+ 5
187	Residence	B	"	27.0	R	65	"	27.0	R	-	-	* 70	+ 5
187A	Residence	B	"	39.0	R	62	"	39.0	R	-	-	* 67	+ 5
187B	Residence	B	"	29.0	R	64	"	29.0	R	-	-	* 70	+ 6
189	Residence	B	"	21.0	R	66	"	22.0	R	-	-	* 72	+ 6
190	Residence	B	"	31.0	R	64	"	35.0	R	-	-	* 68	+ 4
190A	Business	C	"	36.0	R	63	"	72.0	R	-	-	62	- 1
191	Business	C	"	18.0	L	67	"	18.0	L	-	-	* 73	+ 6
191A	Business	C	"	38.0	L	62	"	38.0	L	-	-	68	+ 6
191B	Business	C	"	17.0	L	68	"	15.0	L	-	-	* 74	+ 6
191C	Residence	B	"	58.0	L	58	"	27.0	L	-	-	* 70	* + 12
192	Residence	B	"	83.0	L	55	"	34.0	L	-	-	* 69	* + 14
193	Residence	B	"	97.0	L	53	"	34.0	L	-	-	* 69	* + 16
194	Residence	B	"	108.0	L	52	"	32.0	L	-	-	* 69	* + 17
195	Residence	B	"	125.0	L	50	"	34.0	L	-	-	* 69	* + 19
196	Residence	B	"	131.0	L	50	"	34.0	L	-	-	* 69	* + 19
196A	Residence	B	"	207.0	L	45	"	72.0	L	-	-	62	* + 17
197	Residence	B	"	27.0	L	65	"	41.0	R	-	-	* 67	+ 2
199	Residence	B	"	68.0	L	57	"	21.0	R	-	-	* 72	* + 15
200	Residence	B	4 MI LOOP	64.0	R	45	"	53.0	R	-	-	65	* + 20
201	Residence	B	"	23.0	L	45	"	31.0	L	-	-	* 69	* + 24
202	Residence	B	"	48.0	L	45	"	57.0	L	-	-	64	* + 19
203	Residence	B	"	75.0	L	45	"	84.0	L	-	-	60	* + 15
204	Residence	B	"	97.0	L	45	"	105.0	L	-	-	58	+ 13

NOTE: Distances are from center of the existing or proposed roadways. -L=> Proposed roadway's noise level contribution.
 All noise levels are hourly A-weighted noise levels. -Y=> Noise level from other contributing roadways
 Category E noise levels shown as exterior/interior (58/48). * => Traffic noise impact (per 23 CFR Part 772).

TABLE 5

FHWA NOISE ABATEMENT CRITERIA SUMMARY

Greensboro Outer Loop & Relocated US 70 in Greensboro
 Guilford County, State Proj.# 6.498003T & 8.1492901, TIP # U-2525A & U-2581A

Description	Maximum Predicted Leq Noise Levels dBA			Contour Distances (Maximum)		Approximate Number of Impacted Receptors According to Title 23 CFR Part 772				
	15 m	30 m	60 m	72 dBA	67 dBA	A	B	C	D	E
Loop From Station 1+340 to Rel. US 70	76	72	67	43 m	70 m	0	6	0	0	0
Loop From Rel. US 70 to Station 4+510	75	71	66	39 m	64 m	0	1	0	0	0
Gallant Estates Mobile Home Park	--	--	--	----	----	0	14	1	0	0
Rel. US 70 From Loop to Mt. Church Rd.	72	68	62	20 m	38 m	0	8	0	0	0
Rel. US 70 From SR2581 (Penry Rd) to Loop	73	69	63	25 m	46 m	0	38	9	0	0
TOTALS						0	67	10	0	0

NOTES - 1. 15 m, 30 m, and 60 m distances are measured from center of nearest travel lane.
 2. 72 dBA and 67 dBA contour distances are measured from center of proposed roadway.

TABLE 6

TRAFFIC NOISE LEVEL INCREASE SUMMARY

Greensboro Outer Loop & Relocated US 70 in Greensboro
 Guilford County, State Proj.# 6.498003T & 8.1492901, TIP # U-2525A & U-2581A

Section	RECEPTOR EXTERIOR NOISE LEVEL INCREASES							Substantial Noise Level Increases(1)	Impacts Due to Both Criteria(2)
	<=0	1-4	5-9	10-14	15-19	20-24	>= 25		
Loop- Sta 1+340 to Rel. US70	13	1	3	1	1	2	2	6	6
Loop- Rel. US70 to Sta 4+510	0	1	2	0	0	0	1	1	1
Gallent Estates MH Park	0	0	1	21	4	11	0	15	2
Rel. US70- Loop to Mt. Ch. Rd.	15	22	13	1	0	0	0	1	1
Rel. US70- SR2581 to Loop	1	2	50	3	8	2	0	12	8
TOTALS	29	26	69	26	13	15	3	35	18

(1) As defined by only a substantial Increase (See bottom of Table 2).

(2) As defined by both criteria in Table 2.

TABLE 7
DEFINITION OF SUBSTANTIAL INCREASE

Hourly A-Weighted Sound Level - decibels (dBA)

Existing Noise Level in Leq(h)	Increase in dBA from Existing Noise Levels to Future Noise Levels
< 50	> 15
> 50	> 10

Source: North Carolina DOT Noise Abatement Guidelines

TABLE 8
RELATIONSHIP BETWEEN DECIBEL, ENERGY, AND LOUDNESS

A-Level Down	Remove _____ % of Energy	Divide Loudness by
3 dBA	50	1.2
6 dBA	75	1.5
10 dBA	90	2
20 dBA	99	4

TABLE 9
BARRIER ATTENUATION

Reduction in Sound Level	Reduction in Acoustic Energy	Degree of Difficulty
5 dBA	70%	Simple
10 dBA	90%	Attainable
15 dBA	97%	Very Difficult
20 dBA	99%	Nearly Impossible

Greensboro Outer Loop & Relocated US 70, Greensboro
Guilford County, State Project 6.498003T & 8.1492901
TIP # U-2525A & U2581A

BARRIER LOCATION 1 - Gallant Estate Mobile Home Park						
RECEPTOR #	EXISTING NOISE LEVEL	WITHOUT WALL		WITH WALL		
		PREDICTED NOISE LEVEL	PREDICTED NOISE IMPACT	PREDICTED NOISE LEVEL	NOISE LEVEL REDUCTION	PREDICTED NET IMPACT
53	45	69	+ 24	64	- 5	+ 19
58	45	60	+ 25	54	- 6	+ 19
59	45	58	+ 13	54	- 4	+ 9
60	45	56	+ 11	54	- 2	+ 9
64	45	65	+ 20	58	- 7	+ 13
65	45	66	+ 21	59	- 7	+ 14
66	45	65	+ 20	61	- 4	+ 16
67	45	65	+ 20	62	- 3	+ 17
68	45	60	+ 15	56	- 4	+ 11
69	45	60	+ 15	57	- 3	+ 12
70	45	57	+ 12	55	- 2	+ 10
87	45	59	+ 14	59	0	+ 14
88	45	65	+ 20	63	- 2	+ 18

Wall Cost (\$ 163400) / # Benefitted Residences (7) = \$ 23,343 / BR

NOISE BARRIER SUMMARY

Greensboro Outer Loop / Relocated US 70, Greensboro
 Guilford County, State Project # 6.498003T / 8.1492901,
 TIP #U2525A / U2581A

Gallant Estate Mobile Home Park

BARRIER SECTION	BARRIER LOCATION	BARRIER LENGTH (M)	BARRIER HEIGHT (M)
LOCATION # 1 (R53-R93 LEFT)		189	4.5-6.5
1	STA 3+418 Y2-Rev	19	6.0
2	STA 3+400 Y2-Rev	21	6.0
2A	STA 3+379 Y2-Rev	21	6.5
3A	STA 1+609.5 Ramp D	27	6.5
4	STA 1+583 Ramp D	30	6.0
5	STA 1+554 Ramp D	43	6.0
6	STA 1+512.5 Ramp D	28	4.5
7	STA 1+497.5 Ramp D		
Barrier Cost = \$163,400 Benefitted Receptors = 7 Cost per Benefitted Receptors is \$23,343			

1/1

Greensboro Outer Loop / Relocated US 70, Greensboro
Guilford County, State Project # 6.498003T / 8.1492901,
TIP #U2525A / U2581A

BARRIER SECTION	BARRIER LOCATION	BARRIER LENGTH (M)	BARRIER HEIGHT (M)	BARRIER OFFSET (M)	Approximate Elevation of Top of Wall (M)	
LOCATION # 1 (R53-R93 LEFT)		189	4.5-6.5	From CL	Wall Back	Wall Forward
1	STA 3+418 Y2-Rev	19	6.0	15	Start	235.2
2	STA 3+400 Y2-Rev	21	6.0	15	235.6	235.6
2A	STA 3+379 Y2-Rev	21	6.5	18	236.4	236.4
3A	STA 1+609.5 Ramp D	27	6.5	8	236.6	236.1
4	STA 1+583 Ramp D	30	6.0	7	236.2	236.2
5	STA 1+554 Ramp D	43	6.0	7	236.3	234.8
6	STA 1+512.5 Ramp D	28	4.5	7	234.9	End
7	STA 1+497.5 Ramp D					

Barrier Cost = \$163,400 Benefitted Receptors = 7
 Cost per Benefitted Receptors is \$23,343



Route Slip

Distribution:

U.S. Department of
Transportation

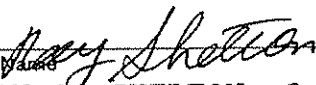
To: Name	Date	Org/Rtg Symbol
STEVE WALKER, Planning and Environmental	05/01/95	NCDOH

Remarks:

- ☐ Per Your Request
- ☒ For Your Information
- ☐ Per Our Conversation
- ☐ Note and Return
- ☐ Discuss With Me
- ☐ For Your Approval
- ☐ For Your Signature
- ☐ Comment
- ☐ Take Appropriate Action
- ☐ Please Answer
- ☐ Prepare Reply For Signature Of

We have received a Draft Design Noise Report for project U-2525A & U-2581A. Based on the current delegation of authority we do not have to review the design phase for these projects, therefore we are returning the Draft Noise Report without any comments.

U-2525A is being handled with a state environmental document and U-2581A is classified as a urban minor arterial in the statewide classification system, therefore not in the National Highway System.

From: Name	Telephone	Org/Rtg Symbol
 ROY C. SHELTON, Operations Engineer	856-4350	HO-NC



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

JAMES B. HUNT, JR.
GOVERNOR

DIVISION OF HIGHWAYS
P.O. BOX 25201, RALEIGH, N.C. 27611-5201

R. SAMUEL HUNT III
SECRETARY

April 26, 1995

MEMORANDUM TO: Mr. Roy C. Shelton
FHWA Operations Engineer

FROM: Mr. H. Franklin Vick, P.E., Manager *H.F. Vick*
Planning and Environmental Branch

SUBJECT: Greensboro Outer Loop & Relocation of
US 70, Guilford Co., Project # 8.1492901
& 6.498003, TIP # U-2581A & U-2525A,
F.A. Proj. # STP-70(22)

DRAFT DESIGN NOISE REPORT

The Draft Design Noise Report for the subject project is attached for your review, recommendations, and comments. After all comments have been reviewed and included into the document, the revised Final Design Noise Report will be sent to you for your formal approval. If I can be of further assistance or answer any questions, please contact me at 733-3141.

cc: Project File Walker

FHWA N. C. DIVISION			
RECD. APR 28 1995			
DIV. ADMIN.			
ASST. DIV. ADMIN.			
ADMIN.			
BRIDGE			
ROW			
SIG.			
T & E			
T & S. ENG.			
CONSP. SPEC.			
F & PD ENGR.			
SECRETARY			
PLA		PM	
PLB		LRV.	
PLC		TR.	
<input checked="" type="checkbox"/> CONSP. ENGR.			
1	2	3	4
5	6	7	8
9	10	11	12
FILE NO.			
TRASH			

Wall was shortened 11m to improve sight-distance @ entrance to Gallant Estates Mobile Home Park.

crossing streets, etc.) due to restricted sight distance is also a concern. Furthermore, to provide a sufficient reduction, a barrier's length would normally be 8 times the distance from the barrier to the receptor. For example, a receptor located 15 meters from the barrier would normally require a barrier 120 meters long. An access opening of 12 meters (10 percent of the area) would limit its noise reduction to approximately 4 dBA (FUNDAMENTAL AND ABATEMENT OF HIGHWAY TRAFFIC NOISE, Report No. FHWA-HHI-HEV-73-7976-1, USDOT, chapter 5, section 3.2, page 5-27). Hence, these factors would not allow noise walls to be acceptable abatement measures along the right-of-way that is not controlled.

The second step of the barrier evaluation involved the computer modeling of noise barriers at the potential location, using the FHWA's noise barrier simulation model, OPTIMA. The analysis was accomplished by developing barriers with OPTIMA which would meet minimum noise reduction goals at the impacted site, by estimating the cost of the barrier, and by determining the cost per benefitted receptor. The NCDOT defines benefitted receptors as all receptors, impacted and non-impacted, which, by placement of the noise mitigation measure, receive a minimum noise level reduction of 4 dBA.

In order for a noise barrier to be considered feasible, it must meet, among other factors, the following conditions:

1. Provide a minimum insertion loss of 6 dBA, preferably 8 dBA or more (for receptors directly adjacent to the project);
2. Located in an acoustic environment where no other noise sources are present.
3. Suitable for construction given the topography of the location.

A primary consideration of the reasonableness of noise barrier installation is that it costs no more than \$25,000 per benefitted receptor (those impacted or non-impacted receptors receiving 4 dBA or more reduction).

Noise abatement, in the form of a concrete barrier, was analyzed for Gallant Estates Mobile Home Park, located in the northeast quadrant of the Relocated US 70 and Greensboro Northern/Eastern Loop interchange. Only the closest 50 mobile homes were used for the study; the addition of the remainder would have added no impacts or benefits. The optimized preliminary design for the noise wall was 189 meters in length, and exposed height ranged from 4.5 to 6.5 meters. This barrier would effectively protect 7 of the 14 impacted receptors of the mobile home park at a cost of \$163,400, or \$23,343 per receptor. This barrier is considered reasonable and feasible by NCDOT guidelines and is recommended for construction, contingent on completion of the project design and the public involvement process.

Greensboro Outer Loop & Relocated US 70, Greensboro
Guilford County, State Project 6.498003T & 8.1492901
TIP # U-2525A & U2581A

BARRIER LOCATION 1 - Gallant Estate Mobile Home Park						
RECEPTOR #	EXISTING NOISE LEVEL	WITHOUT WALL		WITH WALL		
		PREDICTED NOISE LEVEL	PREDICTED NOISE IMPACT	PREDICTED NOISE LEVEL	NOISE LEVEL REDUCTION	PREDICTED NET IMPACT
53	45	69	+ 24	64	- 5	+ 19
58	45	60	+ 25	54	- 6	+ 19
59	45	58	+ 13	54	- 4	+ 9
60	45	56	+ 11	54	- 2	+ 9
64	45	65	+ 20	57	- 8	+ 12
65	45	66	+ 21	58	- 8	+ 13
66	45	65	+ 20	59	- 6	+ 14
67	45	65	+ 20	61	- 4	+ 16
68	45	60	+ 15	56	- 4	+ 11
69	45	60	+ 15	56	- 4	+ 11
70	45	57	+ 12	55	- 2	+ 10
87	45	59	+ 14	57	- 2	+ 12
88	45	65	+ 20	63	- 2	+ 18

Wall Cost (\$ 171400) / # Benefitted Residences (9) = \$ 19,045 / BR

NOISE BARRIER SUMMARY

Greensboro Outer Loop / Relocated US 70, Greensboro
 Guilford County, State Project # 6.498003T / 8.1492901,
 TIP #U2525A / U2581A

Gallant Estate Mobile Home Park

BARRIER SECTION	BARRIER LOCATION	BARRIER LENGTH (M)	BARRIER HEIGHT (M)
LOCATION # 1 (R53-R93 LEFT)		189 198	4.5-6.5
1	STA 3+429.5 Y2-Rev	19 28	6.0
2	STA 3+400 Y2-Rev	21	6.0
2A	STA 3+379 Y2-Rev	21	6.5
3A	STA 1+609.5 Ramp D	27	6.5
4	STA 1+583 Ramp D	30	6.0
5	STA 1+554 Ramp D	43	6.0
6	STA 1+512.5 Ramp D	28	4.5
7	STA 1+497.5 Ramp D		
Barrier Cost = 163,400 ^{163,400} Benefitted Receptors = 9 Cost per Benefitted Receptors is \$19,045			

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Greensboro Outer Loop / Relocated US 70, Greensboro
Guilford County, State Project # 6.498003T / 8.1492901,
TIP #U2525A / U2581A

BARRIER SECTION	BARRIER LOCATION	BARRIER LENGTH (M)	BARRIER HEIGHT (M)	BARRIER OFFSET (M)	Approximate Elevation of Top of Wall (M)	
<u>LOCATION # 1 (R53-R93 LEFT)</u>		198	4.5-6.5	From CL	Wall Back	Wall Forward
1	<i>St 418.0</i> STA 3+429.5 Y2-Rev	28	6.0	15	Start	235.2
2	STA 3+400 Y2-Rev	21	6.0	15	235.6	235.6
2A	STA 3+379 Y2-Rev	21	6.5	15	235.6	236.1
3A	STA 1+609.5 Ramp D	27	6.5	18	236.4	236.4
4	STA 1+583 Ramp D	30	6.0	8	236.6	236.1
5	STA 1+554 Ramp D	43	6.0	7	236.2	236.2
6	STA 1+512.5 Ramp D	28	4.5	7	236.3	234.8
7	STA 1+497.5 Ramp D			7	234.9	End

Barrier Cost = \$171,400 Benefitted Receptors = 9
 Cost per Benefitted Receptors is \$19,045

DESIGN NOISE REPORT

Greensboro Outer Loop & Relocation of US 70,
Guilford County, Project # 8.1492901 & 6.498003,
TIP # U-2581A & U-2525A, F.A. Proj. # STP-70(22)

PROJECT LOCATION/DESCRIPTION

This project consists of building a new four-lane divided freeway facility from 0.6 kilometer (0.4 miles) south of SR 3041 (Clapp Farm Road) to US 70. Also, this project involves the widening and relocation of US 70 from SR 2851 (Penry Road) to SR 2828 (Willowlake Road). Figure N1 illustrates the project study area.

PROCEDURE

Preliminary analysis of the probable traffic noise impacts of this project are contained in the Draft and Final Environmental Impact Statement (EIS) prepared for the Greensboro Eastern/Northern Loop and in environmental documentation prepared for the relocation of US 70. This design noise report presents a more detailed analysis of the improvements based on roadway plans for the subject project.

As part of this evaluation, current existing noise levels were measured in the vicinity of the proposed project. Predictions were also made of the maximum design year peak hour Leq traffic noise levels expected by receptors in the vicinity of the project. The procedure used to predict future noise levels in this study was the FHWA Noise Barrier Cost Reduction Procedure, STAMINA 2.0 and OPTIMA (revised March, 1983). The BCR (Barrier Cost Reduction) procedure is based upon FHWA Highway Traffic Noise Prediction Model (FHWA-RD-77-108).

CHARACTERISTICS OF NOISE

Noise is basically defined as unwanted sound. It is emitted from many sources including airplanes, factories, railroads, power generating plants, and highway vehicles. Highway noise, or traffic noise, is usually a composite of noises from engine exhaust, drive train, and tire-roadway interaction.

The magnitude of noise is usually described by its sound pressure. Since the range of sound pressure varies greatly, a logarithmic scale is used to relate sound pressures to some common reference level, usually the decibel (dB). Sound pressures described in decibels are called sound pressure levels and are often defined in terms of frequency-weighted scales (A, B, C, or D).